Biomechanical Effect of Consistent or Inconsistent Tendon Fiber Orientation in Repaired Rotator Cuff Tendon Using a Rabbit Patch-Graft Model

（書式１８）

学　位　論　文　要　約
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博士論文題目 Title of dissertation

Biomechanical Effect of Consistent or Inconsistent Tendon Fiber Orientation in Repaired Rotator Cuff Tendon Using a Rabbit Patch-Graft Model

（ウサギ腱移植モデルを用いた腱板再建術における移植腱内の腱線維配列の影響に関するバイオメカニクス研究）

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Rotator cuff tear has been treated surgically with focus to cover detached region. There have been few studies to investigate the impact of fiber orientation in repaired or grafted tendon. Moreover, it remains unknown whether the remodeling process in repaired tendon could alter the fiber orientation to improve mechanical properties or not. The purpose of this study was to evaluate the effect of fiber orientation in patch-grafted tendon on biomechanical properties after rotator cuff tear using the rabbit model. A total of 63 rabbits were used. After creating round-shaped defect in the infraspinatus tendon, they were treated with 3 different patch-grafting techniques with consistent (0° group) or inconsistent (45° or 90° groups) fiber orientation to the native tendon. Biomechanical testing and histologic evaluation with the hematoxylin-eosin staining and polarizing microscopy were examined at 4-, 8-, 12- and 20 weeks postoperatively. Tendons without repair surgery were also assessed for biomechanical testing as the control group. At 4 weeks, biomechanical testing showed significantly less ultimate failure loads than the control group regardless tendon fiber orientation in patch-grafts. At 8- and 12 weeks, 45° and 90° groups remained less ultimate failure loads; in contrast, 0° group showed no significant differences in the loads compared to the control group. At 20 weeks, in contrast, increased mechanical strength was obtained among all groups. Histologic evaluation demonstrated the presence of inflammatory cell infiltration in all patch-grafts at 4 weeks. Polarizing microscopic assessment showed all groups increased consistent fiber orientation and fiber continuity at 12 weeks. In conclusion, this study demonstrated patch-graft surgery to cover the defect could achieve biomechanical strength with reorganization of fiber orientation during 20-week follow-up. In contrast, placement of patch-graft with consistent fiber orientation to the native tendon could provide earlier improvement of mechanical strength than with inconsistent fiber orientation. For the treatment of rotator cuff tear, surgery with focus on the consistent fiber orientation in repaired or grafted tendon may provide early improvement of the biomechanical properties during the healing process.

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